Description of a Strain of Trypanosoma brucei *from Zululand.* Part II.—*Susceptibility of Animals.*

By Surgeon-General Sir David Bruce, C.B., F.R.S., A.M.S.; Major A. E. Hamerton, D.S.O., and Captain D. P. Watson, R.A.M.C.; and Lady Bruce, R.R.C. (Scientific Commission of the Royal Society, Nyasaland, 1912–14.)

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Introduction.

In the foregoing paper the morphology of this trypanosome was described, and the conclusion arrived at that it is identical, as regards shape, size and general appearance, with the trypanosome causing disease in man in Nyasaland, the *Trypanosoma rhodesiense* of Stephens and Fantham.

This paper describes the action on animals of the Zululand trypanosome, and it is compared in this regard with the Nyasaland species.

Susceptibility of Animals to T. brucei, Zululand Strain, 1913.

Table I.

Date.	No. of expt.	Source of virus.	Incubation, in days.	Duration, in days.*	Remarks.
			Horse.		
1895.					
—	37	Dog 4	3	35	"Very old animal; typical Nagana."—Shilston.
Sept. 27...	212	Natural infection	?	30	Zululand, 1896, Bruce.
„ 29...	235	„ „	6	49	„ „ „
		Average.....	—	38·0	
			Ox.		
1913.					
—	22	Dog 4	6	—	"Still alive after 90 days."—Shilston.
Feb. 18...	1913	Rat 1839.....	—	—	Never showed trypanosomes.
„ 18...	1914	„ 1839.....	37	—	Still alive after 316 days.
„ 18...	1915	„ 1839.....	35	310	Died of *T. brucei*.
July 22...	2304	Dog 2281.....	—	—	Never showed trypanosomes.
„ 22...	2305	„ 2281.....	—	—	„ „
„ 22...	2306	„ 2281.....	—	—	„ „
			Sheep.		
—	1	Dog 4	12	—	"Still alive after 90 days."—Shilston.

* Duration includes the days of incubation; it dates from day of infection.

Table I—*continued.*

Date.	No. of expt.	Source of virus.	Incubation, in days.	Duration, in days.*	Remarks.
		Goat.			
Feb. 12...	1887	Rats 1832 and 1838 ...	—	—	Never showed trypanosomes.
„ 12...	1888	„ 1832 and 1838 ...	—	—	„ „
„ 12...	1889	„ 1832 and 1838 ...	15	109	Died of *T. brucei.*
„ 12...	1891	„ 1832 and 1838 ...	—	—	Never showed trypanosomes.
Mar. 15...	1890	Guinea-pigs 1840 and 1843	12	45	Died of *T. brucei.*
July 16...	2290	Dog 2254.....	26	39	„ „
„ 16...	2291	„ 2254.....	36	116	„ „
		Average.....	22·2	77·2	
		Monkey.			
Feb. 3...	1833	Rabbit 1830	7	8	Died of *T. brucei.*
„ 3...	1834	„ 1830	7	15	„ „
„ 3...	1835	„ 1830	7	14	„ „
„ 3...	1836	„ 1830	7	49	„ „
„ 3...	1837	„ 1830	7	16	„ „
„ 17...	1970	Laboratory-bred flies...	—	17	„ „
July 16...	2292	Dog 2254.....	5	50	„ „
„ 16...	2293	„ 2254.....	5	65	„ „
		Average.....	6·4	29·2	
		Dog.			
Feb. 14...	1904	Monkey 1835	6	26	Died of *T. brucei.*
„ 14...	1905	„ 1835	6	17	„ „
„ 14...	1906	„ 1835	10	18	„ „
„ 14...	1907	„ 1835	6	23	„ „
„ 14...	1908	„ 1835	6	21	„ „
April 1...	2047	Rat 2027.....	6	15	„ „
„ 1...	2048	„ 2027.....	6	20	„ „
„ 1...	2049	„ 2027.....	6	14	„ „
„ 1...	2050	„ 2027.....	6	17	„ „
„ 1...	2051	„ 2027.....	6	20	„ „
„ 22...	2104	„ 2065.....	6	17	„ „
June 24...	2240	Guinea-pig 2225.....	7	12	„ „
July 3...	2254	Laboratory-bred flies...	?	17	„ „
„ 9...	2281	Guinea-pig 2225	5	20	„ „
„ 16...	2294	Dog 2254.....	5	19	„ „
„ 16...	2295	„ 2254.....	5	22	„ „
Aug. 11...	2361	Wild flies	?	16	„ „
		Average.....	6·1	18·5	
		Rabbit.			
—	145	Dog 1	—	33	Shilston.
—	146	„ 1	—	39	„
—	150	„ 2	—	31	„
—	157	Rat 4A.....	13	34	„
—	158	Horse 37.....	3	27	„
—	165	Rabbit 158	5	27	„
Jan. 13...	1897	Pretoria strain	?	36	Died of *T. brucei.*
„ 17...	1830	„ „	?	35	„ „
		Average.....	7·0	32·7	

* Duration includes the days of incubation; it dates from day of infection.

Table I—*continued.*

Date.	No. of expt.	Source of virus.	Incubation, in days.	Duration in days.*	Remarks.
		Guinea-pig.			
Feb. 3...	1840	Rabbit 1830	31	50	Died of *T. brucei.*
„ 3...	1841	„ 1830	35	50	„ „
„ 3...	1842	„ 1830	—	—	Never showed trypanosomes.
„ 3...	1843	„ 1830	21	59	Died of *T. brucei.*
„ 3...	1844	„ 1830	14	37	„ „
„ 13...	1895	Pretoria strain	—	—	Never showed trypanosomes.
„ 13...	1896	„ „	—	—	„ „
Mar. 28...	1842	Monkey 1970	10	27	Reinjected; died of *T. brucei.*
„ 28...	1895	„ 1970	20	46	„ „ „
„ 28...	1896	„ 1970	20	30	„ „ „
May 13...	2136	„ 1970	—	—	Never showed trypanosomes.
„ 29...	2136	„ 1970	4	15	Reinjected; died of *T. brucei.*
June 13...	2225	„ 1970	3	34	Died of *T. brucei.*
July 16...	2296	Dog 2254.....	47	89	„ „
		Average.....	20·5	43·7	
		Rat.			
Feb. 2...	1828	Rabbit 1830	8	19	Died of *T. brucei.*
„ 2...	1829	„ 1830	6	58	„ „
„ 3...	1832	„ 1830	7	46	„ „
„ 3...	1838	„ 1830	10	13	„ „
„ 3...	1839	„ 1830	7	22	„ „
„ 14...	1902	„ 1897	17	31	„ „
„ 26...	1966	Guinea-pig 1844	8	23	„ „
Mar. 15...	1993	Rat 1832.....	5	13	„ „
„ 15...	1994	„ 1832.....	5	10	„ „
„ 15...	1995	„ 1832.....	5	30	„ „
„ 19...	2006	Monkey 1970	5	24	„ „
April 4...	2065	„ 1836	7	30	„ „
„ 11...	2073	Rat 2065.....	4	17	„ „
May 13...	2135	Monkey 1970	6	33	„ „
„ 13...	2137	Goat 1889	6	18	„ „
„ 13...	2138	„ 1889	6	17	„ „
„ 29...	2196	Rat 2135.....	11	26	„ „
July 16...	2288	Dog 2254.....	5	33	„ „
„ 16...	2289	„ 2254.....	5	44	„ „
Sept. 2...	2406	„ 2361.....	6	24	„ „
„ 16...	2412	Rat 2406.....	6	34	„ „
Oct. 20...	2423	„ 2412.....	8	39	„ „
Nov. 28...	2442	„ 2431.....	4	16	„ „
		Average.....	6·8	27·0	

* Duration includes the days of incubation; it dates from day of infection.

Disease set up in Various Animals by T. brucei, *Zululand Strain*, 1913.

Horse.—The Commission had no opportunity of studying this strain in the horse, but Mr. Shilston states that one horse inoculated by him at Pietermaritzburg died in 35 days with typical symptoms of Nagana.

Ox.—Six oxen were inoculated, but only two of these at any time showed trypanosomes in their blood. One of these died after 310 days, while the

other is still alive at the end of a year. This animal has evidently recovered, as it appears sleek and healthy. The action of the Zululand strain is therefore the same as that of the trypanosome causing disease in man in Nyasaland: neither of them show any marked power of producing serious disease in cattle.

Goat.—Seven goats were inoculated with this strain. Four died, on an average, in 77·2 days (45 to 116). The remaining three proved refractory. No œdema of face or corneal opacity was noted in any of the goats. The Zululand strain seems to have less action on goats than the Nyasaland trypanosome, but the number of experiments is small. In the latter the duration of the disease was 41·8 days (19 to 72).

Sheep.—No experiments were made with these animals in Nyasaland as it was found impossible to procure them from the natives.

Monkey.—Eight monkeys died, on an average, in 29·2 days (8 to 65). The trypanosomes were always present in the blood, sometimes in enormous numbers. In no case was œdema of the face or corneal opacity noted. After death, enlargement of the spleen and liver, gelatinous infiltration at the base of the heart, and hæmorrhages in the epicardium were found.

Dog.—Seventeen dogs were inoculated. All died, on an average, in 18·5 days (12 to 26). In eight dogs blindness caused by opacity of the cornea was a prominent symptom, and in two swellings of the limbs were observed.

Rabbit.—As only two rabbits were available at Kasu, six experiments reported by Mr. Shilston are added. Eight rabbits died, on an average, in 32·7 days (27 to 39). The course of the disease in the Kasu rabbits was the same as that described in a former paper* as being typical of Nagana.

Guinea-pig.—This animal is less affected by the disease than the rabbit. Ten were used; all took the disease and died, but four required to be inoculated more than once. They died, on an average, in 43·7 days (15 to 89). No prominent symptoms, such as are seen in the rabbit, occur in the guinea-pig.

Rat.—Twenty-three were inoculated and died, on an average, in 27 days (10 to 58), with their blood swarming with trypanosomes and their spleens enormously enlarged.

* "The Trypanosome causing Disease in Man in Nyasaland.—Susceptibility of Animals o the Human Strain," 'Roy. Soc. Proc.,' B, vol. 87 (1913).

Table II.—The Average Duration, in Days, of the Disease in Various Animals caused by *T. brucei*, Zululand Strain, 1913.

	Horse.	Ox.	Goat.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Average duration, in days	38	310	77	29	18	33	44	27
Number of animals employed	3	1	7	8	17	8	10	23

Compare this with the following table:—

Table III.—The Average Duration of Life, in Days, of Various Animals Infected with the Human Strain of the Trypanosome causing Disease in Man in Nyasaland.

	Horse.	Ox.	Goat and sheep.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Average duration, in days	0	134	42	26	34	28	67	30
Number of animals employed	0	1	29	20	25	7	15	21

Table IV.—The Percentages of Recoveries in Various Animals Infected with *T. brucei*, Zululand Strain, 1913.

	Horse.	Ox.	Goat.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Percentages	0	83	0	0	0	0	0	0
Number of animals employed	3	6	4	8	17	8	10	23

Compare this with the following table:—

Table V.—The Percentages of Recoveries in Various Animals Infected with the Trypanosome causing Disease in Man in Nyasaland.

	Horse.	Ox.	Goat and sheep.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Percentages	0	80	0	0	0	0	0	0
Number of animals employed	0	5	29	20	25	7	15	21

Conclusion.

The pathogenic action of *T. brucei*, Zululand strain, 1913, on various animals is so similar, not only in regard to the symptoms during life but also in the *post-mortem* appearances and rate of mortality, to that of the trypanosome causing disease in man in Nyasaland, that it affords another proof that these two trypanosomes are identical.

The Trypanosome causing Disease in Man in Nyasaland. Part III.—*Development in* Glossina morsitans.

By Surgeon-General Sir David Bruce, C.B., F.R.S., A.M.S.; Major A. E. Hamerton, D.S.O., and Captain D. P. Watson, R.A.M.C.; and Lady Bruce, R.R.C. (Scientific Commission of the Royal Society, Nyasaland, 1912–14.)

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[Plate 24.]

Introduction.

In previous papers* the morphology of this trypanosome and the susceptibility of various animals to its pathogenic action have been described. In this is given an account of its development in *Glossina morsitans*.

In Uganda the study of the development of *Trypanosoma gambiense* in *G. palpalis* was much assisted by the circumstance that large numbers of laboratory-bred tsetse flies were available. This was due to the fact that the pupæ of *G. palpalis* could be collected on the lake-shore in practically unlimited numbers. It is quite otherwise with *G. morsitans*. It has been found impossible to find the pupæ of this species in any numbers, so that all laboratory-bred *G. morsitans* have had to be hatched out of pupæ obtained from captive flies, a slow and laborious process. The flies are caught some 20 to 30 miles from the laboratory and brought up to Kasu camp by a native on a bicycle. This kills a large number of the flies. Moreover, the climatic conditions at the camp are not always favourable for breeding and hatching out. This was remedied to some extent by establishing a breeding station down in the low-country, but as this had to be left in the charge of natives the results were not always very satisfactory.

* 'Roy. Soc. Proc.,' B, vol. 85 (1912), and B, vols. 86 and 87 (1913).